JC10 Rec'd PCT/PTO 19 FEB 2002

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371	ATTORNEY'S DOCKET NUMBER 21029/0240 U.S. APPLICATION NO. (If known, see 37 CFR 1.5) 10/049838

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/FR00/02242	3 August 2000	19 August 1999

TITLE OF INVENTION
IMPROVEMENTS MADE TO FLAT GLASS ANNEALING LEHRS

APPLICANT(S) FOR DO/EO/US
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Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. § 371.
3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.

5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   - a. ☒ is transmitted herewith (required only if not transmitted by the International Bureau).
   - b. ☐ has been transmitted by the International Bureau.
   - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).

7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   - a. ☒ are transmitted herewith (required only if not transmitted by the International Bureau).
   - b. ☐ have been transmitted by the International Bureau.
   - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   - d. ☐ have not been made and will not be made.

8. ☒ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ A translation of the Annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☐ A FIRST preliminary amendment.
    ☐ A SECOND or SUBSEQUENT preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter
16. ☒ Other items or information:

Certified Copy of Priority Document (99/10644); International Preliminary Examination Report (IPER); International Search Report (ISR)

JC11 Rec'd PCT/PTO 19 FEB 2002

U.S. APPLICATION NO. (If known, see [illegible] R 1 5)	INTERNATIONAL APPLICATION NO	ATTORNEY'S DOCKET NUMBER
10/049838	PCT/FR00/02242	21029/0240

				CALCULATIONS	PTO USE ONLY
☒ The following fees are submitted: **Basic National Fee (37 CFR 1.492(a)(1)-(5)):** Search Report has been prepared by the EPO or JPO.......... **$890.00** International preliminary examination fee paid to USPTO (37 CFR 1.482) .... **$710.00** No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)).......... **$740.00** Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO.......... **$1,040.00** International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4).......... **$100.00**					
ENTER APPROPRIATE BASIC FEE AMOUNT =				**$890.00**	
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).				$	
Claims	Number Filed	Number Extra	Rate		
Total Claims	10 - 20 =	0	X $18.00	**$0.00**	
Independent Claims	1 - 3 =	0	X $84.00	**$0.00**	
Multiple dependent claim(s)(if applicable)			+ $280.00	**$0.00**	
TOTAL OF ABOVE CALCULATIONS =				**$890.00**	
Reduction by 1/2 for filing by small entity, if applicable.				$	
SUBTOTAL =				**$890.00**	
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).				$	
TOTAL NATIONAL FEE =				**$890.00**	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property +				**$40.00**	
TOTAL FEES ENCLOSED =				**$930.00**	
				Amount to be: refunded	$
				charged	$

a. ☐ A check in the amount of $___ to cover the above fees is enclosed.
b. ☒ Please charge my Deposit Account No. 22-0185 in the amount of $930.00 to cover the above fees. A duplicate copy of this sheet is enclosed.
c. ☒ The Director is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 22-0185. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b) must be filed and granted to restore the application to pending status

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Morris Liss

SIGNATURE

Morris Liss
NAME

24,510
REGISTRATION NUMBER

10/049838

Improvements made to flat glass annealing lehrs

ABSTRACT OF THE DISCLOSURE

Flat glass annealing lehr equipped with controlled heating and cooling means comprising, in particular, pre-annealing, annealing, and post-annealing zones with heat exchange by radiation, the said zones being equipped respectively with groups of cooling-air heat exchangers situated above and/or beneath the glass ribbon, comprising:

- a single cooling-air intake manifold for the groups of exchangers in the pre-annealing and annealing zones, which manifold is situated where the said zones meet, and
- a single cooling-air intake manifold for the groups of exchangers in the annealing and post-annealing zones, which manifold is situated where the said zones meet.

The present invention relates to improvements made to flat glass annealing lehrs.

It is known that flat glass annealing lehrs are tunnel furnaces, equipped with controlled heating and cooling means making it possible to cause the glass ribbon to follow a continuous cooling thermal cycle.

A lehr according to the current state of the art has been depicted schematically in Figures 1 and 2 of the appended drawings: Figure 1 depicts the various zones that make up this lehr and the curve of the glass annealing thermal cycle which results from it, and Figure 2 is a section on a longitudinal vertical plane of this lehr.

Referring to Figures 1 and 2, it can be seen that the zones of which the lehr is composed are generally defined as follows:

Zone AO : special inlet zone for particular treatment,
Zone A : pre-annealing zone,
Zone B : annealing zone,
Zone C : post-annealing zone,
Zone D : temperate direct cooling zone,
Zone F : final direct cooling zone.

Zones A, B and C are zones in which heat exchange is by radiation and zones D and F are cooling zones in which heat exchange is by convection.

The most critical phase in the cycle of annealing the glass ribbon is in zones A and B in which the glass is in a viscoelastic state allowing the stresses generated in the glass ribbon during the operations of forming it to relax. Poor control over the cooling of the glass ribbon in these zones can give rise to temperature gradients in the glass which will generate stresses

which may remain in the form of residual stresses.

Referring to Figure 2 in which, in this lehr according to the prior art, only the heat exchangers situated above the glass ribbon 1 are depicted (the heating means and the exchangers which are situated beneath this glass ribbon are not depicted in this figure), 2 has been used to depict the system of mechanized rollers which supports and drives the glass ribbon 1 which passes through the lehr.

In zone A, a fan 4 draws in external air at ambient temperature, through a manifold 3 which supplies several groups of exchangers 5 covering the surface of the glass ribbon 1. The exchanger 5 consists of a certain number of groups of tubes of circular, rectangular or some other cross section, arranged across the width of the glass ribbon so as to vary the cooling across the width of this ribbon. The air flow rate drawn into each group of exchanger tubes 5 is regulated via a series of valves such as 6 which are installed upstream or downstream of each group of exchanger tubes 5 and the degree of opening of which allows the cooling air flow rate to be adjusted according to the target temperature set at the end of the zone A.

In zone B, a fan 7 recirculates air through several groups of exchanger tubes 8 distributed across the width of the glass ribbon 1. The temperature of the recirculated air in the groups of exchangers 8 can be adjusted by providing a hot air exhaust through the manifold 9 and by regulating some valves such as 10 and 11 which control the dilution of ambient air in the recirculated air. The air flow rate passing through each group of exchangers 8 can be adjusted via valves such as 12 which are installed upstream or downstream of each group of exchanger tubes 8 and the degree of opening of which allows the cooling air flow rate to be

adjusted according to the target temperature fixed at the end of this zone B.

In zone C, a fan 14 draws in external air at ambient temperature through a manifold 17 which supplies several groups of exchanger tubes 16 covering the surface of the glass ribbon 1. The air flow rate drawn into each group of exchangers 16 is regulated via a series of valves such as 13 installed upstream or downstream of each group of exchanger tubes 16, according to the target temperature for the end of this zone C.

All the air temperatures and flow rates of air passing through the groups of exchangers in zones A, B and C are controlled by a regulating system operating each valve such as 6, 10, 11, 12 and 13, on the basis of information transmitted by temperature sensors which are installed at the end of each zone and across the width of the glass ribbon.

A study of Figure 2 reveals that the obligation for the ducts connecting the exchanger tubes where zones A and B and where zones B and C meet to pass through the roof of the lehr, the bulk of the valves such as 6, 12, 13, and the need to provide means for compensating for the expansion of the exchanger tubes (not depicted in the figure), make it essential to separate the groups of exchangers of zones A, B and C by distances denoted by the references X and Y in Figure 2 and known as inter-zone regions. The length of the inter-zone regions is generally of the order of 1.5 metres.

It can be seen that over the distance of the inter-zone regions X and Y, the glass strip is not subjected to the controlled radiation of the exchangers. It is therefore evident that its cooling is not controlled during the time needed for the glass ribbon to cover these inter-zone regions. In consequence, the

temperature curve does not have an even profile while the glass ribbon is passing through these inter-zone regions X and Y. The glass, in these inter-zone regions, is at a temperature level which corresponds to a critical viscoelastic state. This non-uniformity of the glass ribbon cooling curve generates stresses in this glass which may remain right up to the end of cooling, in the form of residual stresses.

Figure 3 of the appended drawings shows the temperatures of the glass ribbon and of the air passing through the exchanger tubes of zones A, B and C and over the length of the inter-zone regions X and Y. Curve 18 shows the change in glass ribbon skin temperature and curves 19, 20 and 21 shows that of the temperature of the air passing through the exchanger tubes in each zone.

The glass ribbon skin temperature (curve 18) decreases between the entries and exits of zones A, B and C:
In the case of Zone A: between points A and B;
In the case of Zone B: between points C and D;
In the case of Zone C: between points E and F.

A study of curves 19, 20 and 21 shows that the temperature of the air passing through the exchanger tubes:
In the case of Zone A: increases between points J and K;
In the case of Zone B: increases between points M and L;
In the case of Zone C: increases between points O and N.

As the inter-zone regions X and Y are not controlled, an increase in the glass ribbon skin temperature occurs therein. These increases in temperature are represented by the curve 18:
The inter-zone region for Zone A and Zone B, between the points B and C,
The inter-zone region for Zone B and Zone C, between the points D and E.

This lack of control over the heat exchange at the inter-zone regions X and Y disturbs the glass ribbon cooling curve in a range of temperatures that correspond to the viscoelastic domain, and this may give rise to the appearance of stresses, some of which will remain after total cooling, to the detriment of the quality of the glass produced.

It will be appreciated that the temperature difference of the glass in the inter-zone regions X and Y, for a given setting of the lehr, will vary according to the thickness of the glass ribbon or according to the speed at which it travels, which is dependent on the production of the line.

The present invention sets out to provide a solution to the technical problem mentioned hereinabove by eliminating the discontinuity in the glass ribbon annealing curve, which discontinuity is generated by the presence of the inter-zone regions X and Y in the lehrs according to the current state of the art, this being so as to improve appreciably the quality of the end product.

In consequence, the present invention relates to a flat glass annealing lehr equipped with controlled heating and cooling means comprising, in particular, pre-annealing, annealing, and post-annealing zones with heat exchange by radiation and temperature direct cooling zones and final direct cooling zones with heat exchange by convection, the said zones being equipped respectively with groups of cooling-air heat exchangers situated above and/or beneath the glass ribbon, characterized in that it comprises:

- a single cooling-air intake manifold for the groups of exchangers in the pre-annealing and annealing zones, which manifold is situated where the said zones meet, and

- a single cooling-air intake manifold for the groups of exchangers in the annealing and post-annealing zones, which manifold is situated where the said zones meet.

According to the present invention, the single manifold located where the annealing and post-annealing zones meet may be produced in the form of a ducts, divided vertically into two sections to which the groups of exchangers of the annealing zone and those of the post-annealing zone are connected.

The present invention is also aimed at a system for controlling the temperature of the cooling air on intake to the annealing zone and on discharge from the post-annealing zone, this possibility of regulating the lehr allowing the temperatures of the cooling air passing through the groups of exchangers to be optimized, thus making it possible to obtain the ideal cooling curve for the glass ribbon passing through the lehr. This result is obtained according to the invention irrespective of the thickness of the glass ribbon and of the production of the line.

Other features and advantages of the present invention will become apparent from the description given hereinafter with reference to Figures 4 and 5 of the appended drawings, in which:

- Figure 4 is a schematic depiction similar to Figure 2, of a flat glass annealing lehr equipped with the improvements which are the subject of the present invention, and
- Figure 5 illustrates the control system provided on the lehr illustrated by Figure 4.

We refer first of all to Figure 4 which illustrates a preferred but non-limiting embodiment of the subject of the invention. This figure again shows the zones A, B

and C of Figure 2, together with the various elements that make up the systems for heat exchange by radiation, described hereinabove, these elements being given the same references as those used in Figure 2.

According to the present invention, the fan in zone A has been eliminated and the tubes of the groups of exchangers 5 have been connected to a single manifold 23. Likewise, the exchanger tubes 8 of the zone B are also connected to this same manifold 23, the latter being situated where the zones A and B meet. The manifold 23 is connected to the intake of a fan 24 installed, for example, in zone B, and which draws in air that passes through the exchanger tubes 5 of zone A and through the exchanger tubes 8 of zone B.

Thanks to this arrangement, the inter-zone region X, where the zones A and B meet in lehrs according to the prior art, and in which the glass ribbon 1 was not correctly cooled, is eliminated. Thus, by virtue of the invention, control of the glass ribbon cooling curve is continuous, thus eliminating any risk of additional stresses appearing in the glass, which stresses might remain in the end product.

In order to eliminate the discontinuity of annealing in the inter-zone region Y between the zones B and C of installations according to the prior art, the invention envisages a single cooling air intake manifold 25 for the groups of exchangers of zones B and C, this single manifold 25 being situated where the zones B and C meet. According to the present invention, this manifold can be produced in the form of a duct divided vertically in its cross section by a partition, and to which, on the zone B side, the groups of exchangers 8 are connected and, on the zone C side, the groups of exchangers 16 are connected.

Thanks to this arrangement, it is possible to obtain

perfect smoothing of the glass ribbon annealing curve throughout the range of temperatures for which this ribbon is in a critical viscoelastic state and for which it is exposed to exchange by radiation in the zones A, B and C, characterized by:

In the case of zone A : antimethodic exchange: cold air parallel current - the air flows through the groups of exchangers parallel to the direction of travel of the glass ribbon;

In the case of zone B : methodic exchange: recirculated hot air countercurrent - the air flows through the groups of exchangers in the opposite direction to the direction of travel of the glass ribbon;

In the case of zone C : methodic exchange: cold air countercurrent - the air flows through the groups of exchangers in the opposite direction to the direction of travel of the glass ribbon.

The invention is also aimed at a control and regulating system which is illustrated in Figure 5. This system has the following features:

Zone A:

One or more temperature sensors are provided, these consisting, for example, of thermocouples such as TCA, situated at the end of zone A and which measure the temperature of the glass ribbon as it leaves this zone. These temperature sensors are connected to a temperature regulator RA1 having, as its reference point, the desired temperature for the end of zone A

and which act on a series of motorized valves 22 regulating the flow rate of cold air passing through each of the groups of exchanger tubes 5 in this zone.

Zone B:

This also comprises one or more temperature sensors, consisting for example of thermocouples such as TCB1 situated at the end of zone B and which measure the temperature of the glass ribbon as it leaves this zone. These temperature sensors are connected to a temperature regulator RB1 having, as its reference point, the desired temperature for the end of zone B and which act on a series of motorized valves 12 regulating the flow rate of air recirculated through each group of exchangers in this zone.

This zone also comprises means for controlling and regulating the temperature of the recirculated air passing through the groups of exchangers 8. These means consist of temperature sensors such as thermocouples TCB2 installed in the inlet ducts of the groups of exchangers 8 and a temperature regulator RB2 to which the temperature sensors are connected and which receives its temperature reference point from a thermocouple TCC1 installed in the intake duct of the fan 14 of zone C so as to regulate the temperature of the air at the inlet to the exchangers 8, via the regulating valves 10 and 11.

As in the lehr illustrated by Figure 3, in the case of the lehr illustrated in Figure 4, the temperature of the air recirculated through the groups of exchangers 8 is adjusted by a discharge of air through the manifold 9 and by regulating the valves 10 and 11 controlling the dilution of ambient air in the recirculated air.

Zone C:

This zone also comprises one or more temperature sensors such as, for example, thermocouples TCC2, situated at the end of zone C so as to measure the temperature of the glass ribbon leaving this zone. These temperature sensors are connected to a temperature regulator RC1 having, as its reference point, the desired temperature for the end of zone C and acting on a series of motorized valves 26 which regulate the flow rate of air recirculated through each group of exchangers 16 of this zone C.

The temperature measurements taken by all the temperature sensors in each of the zones concerned allow the lehr control system to adapt the temperatures and flow rates of air in the exchangers of each zone so as to obtain a glass ribbon temperature curve similar to the theoretical annealing curve.

Each group of exchangers arranged transversely on the glass ribbon in each of the zones A, B and C makes it possible to control the cooling of this ribbon across its width, for example to encourage more cooling of its centre compared with its edges.

According to the present invention, the regulators employed in this control system may be of the conventional type or may alternatively be built into a regulating system employing algorithms of the fuzzy logic or neuro-predictive type.

Of course, the present invention is not restricted to the exemplary embodiments described and/or depicted but encompasses all variants thereof. Thus, it is obvious to the person skilled in the art that the device that is the subject of the invention, an application of which has been described hereinabove in the case of exchangers positioned above the glass ribbon, can apply

not only to these but also, and at the same time, to exchangers situated above and beneath the glass ribbon.

Claims

1. Flat glass annealing lehr equipped with controlled heating and cooling means comprising, in particular, pre-annealing (A), annealing (B), and post-annealing (C) zones with heat exchange by radiation, the said zones being equipped respectively with groups of cooling-air heat exchangers situated above and/or beneath the glass ribbon, characterized in that it comprises:
- a single cooling-air intake manifold (23) for the groups of exchangers in the pre-annealing (A) and annealing (B) zones, which manifold is situated where the said zones meet, and
- a single cooling-air intake manifold (25) for the groups of exchangers in the annealing (B) and post-annealing (C) zones, which manifold is situated where the said zones meet.

2. Lehr according to Claim 1, characterized in that the single manifold (25) located where the annealing (B) and post-annealing (C) zones meet is produced in the form of a ducts, divided vertically into two sections to which the groups of exchangers (8) of the annealing zone (B) and those (16) of the post-annealing zone (C) are connected.

3. Lehr according to one of Claims 1 and 2, characterized in that it comprises a single fan (24) installed in the zone (B) and which draws in the air that flows through the groups of exchangers (5) of the zone (A) and through the groups of exchangers (8) of the zone (B).

4. Lehr according to any one of the preceding claims, characterized in that it comprises a system for controlling the temperature of the cooling air on intake to zone (B) and on discharge from zone (C).

5. Lehr according to Cláim 4, characterized in that the said temperature-control system comprises:

- one or more temperature sensors (TCA) situated at the end of the pre-annealing zone (A),
- a temperature regulator (RA1) to which the temperature sensors (TCA) are connected and which has, at its reference point, the desired temperature for the end of zone (A),
- a number of motorized valves (22) actuated by the said regulator and which regulate the air flow rate passing through each group of exchangers (8) of zone (A),
- one or more temperature sensors (TCB1) situated at the end of the annealing zone (B),
- a temperature regulator (RB1) to which the said temperature sensors (TCB1) are connected and which has, as its reference point, the desired temperature for the end of zone (B),
- a number of motorized valves (12) actuated by the said regulator (RB1) and which regulate the flow rate of air recirculated through each group of exchangers (8) of the said zone (B);
- a system for controlling the temperature of the recirculating air passing through the exchangers (8) of the said annealing zone (B) and which comprises one or more temperature sensors (TCB2) installed in the inlet ducts of the said exchangers, a temperature regulator (RB2) receiving its temperature reference point from a temperature sensor (TCC1) installed in the intake duct of the said exchangers (8) and regulating the air temperature on inlet into the said exchangers via regulating valves (10, 11);
- one or more temperature sensors (TCC2) at the end of the post-annealing zone (C);
- a temperature regulator (RC1) to which the said temperature sensors (TCC2) are connected and which has as its reference point the desired temperature

for the end of zone (C), and

- a number of motorized valves (26) regulating the air flow rate recirculated through the exchangers (16) of the said zone (C).

6. Lehr according to Claim 5, characterized in that the said temperature control system, on the basis of temperature measurements taken by all of the said temperature sensors of each of the said zones (A, B and C), adapts the temperatures and the flow rates of air in the exchangers of the said zones in such a way as to obtain a glass ribbon temperature curve similar to the theoretical annealing curve.

7. Lehr according to one of Claims 5 and 6, characterized in that the said regulators are built into a centralized regulating system employing algorithms of the fuzzy logic type.

8. Lehr according to one of Claims 5 and 6, characterized in that the said regulators are built into a centralized regulating system employing neuro-predictive algorithms.

Claims

1. Flat glass annealing lehr equipped with controlled heating and cooling means comprising, in particular, pre-annealing, annealing, and post-annealing zones with heat exchange by radiation, the said zones being equipped respectively with groups of cooling-air heat exchangers situated above and/or beneath the glass ribbon, said lehr further comprising:
   - a single cooling-air intake manifold for the groups of exchangers in the pre-annealing and annealing zones, which manifold is situated where the said zones meet, and
   - a single cooling-air intake manifold for the groups of exchangers in the annealing and post-annealing zones, which manifold is situated where the said zones meet.

2. Lehr according to Claim 1, wherein the single manifold located where the annealing and post-annealing zones meet is produced in the form of a ducts, divided vertically into two sections to which the groups of exchangers of the annealing zone and those of the post-annealing zone are connected.

3. Lehr according to Claim 1 further comprising a single fan installed in the annealing zone and which draws in the air that flows through the groups of exchangers of the pre-annealing zone and through the groups of exchangers of the annealing zone.

4. Lehr according to Claim 1, comprising a system for controlling the temperature of the cooling air on intake to annealing zone and on discharge from post-annealing zone.

5. Lehr according to Claim 4, wherein said temperature-control system comprises:

- one or more temperature sensors situated at the end of the pre-annealing zone,
- a temperature regulator to which the temperature sensors are connected and which has, at its reference point, the desired temperature for the end of pre-annealing zone,
- a number of motorized valves actuated by the said regulator and which regulate the air flow rate passing through each group of exchangers of pre-annealing zone,
- one or more temperature sensors situated at the end of the annealing zone,
- a temperature regulator to which the said temperature sensors are connected and which has, as its reference point, the desired temperature for the end of annealing zone,
- a number of motorized valves actuated by the said regulator and which regulate the flow rate of air recirculated through each group of exchangers of the said annealing zone ;
- a system for controlling the temperature of the recirculating air passing through the exchangers of the said annealing zone and which comprises one or more temperature sensors installed in the inlet ducts of the said exchangers, a temperature regulator receiving its temperature reference point from a temperature sensor installed in the intake duct of the said exchangers and regulating the air temperature on inlet into the said exchangers via regulating valves ;
- one or more temperature sensors at the end of the post-annealing zone ;
- a temperature regulator to which the said temperature sensors are connected and which has as its reference point the desired temperature for the end of post-annealing zone, and
- a number of motorized valves regulating the air

flow rate recirculated through the exchangers of the said post-annealing zone.

6. Lehr according to Claim 5, said temperature control system, on the basis of temperature measurements taken by all of the said temperature sensors of each of the pre-annealing, annealing and post-annealing zones, adapts the temperatures and the flow rates of air in the exchangers of the said zones in such a way as to obtain a glass ribbon temperature curve similar to the theoretical annealing curve.

7. Lehr according to Claims 5 and 6, wherein the said regulators are built into a centralized regulating system employing algorithms of the fuzzy logic type.

8. Lehr according to Claims 5 and 6, wherein said regulators are built into a centralized regulating system employing neuro-predictive algorithms.

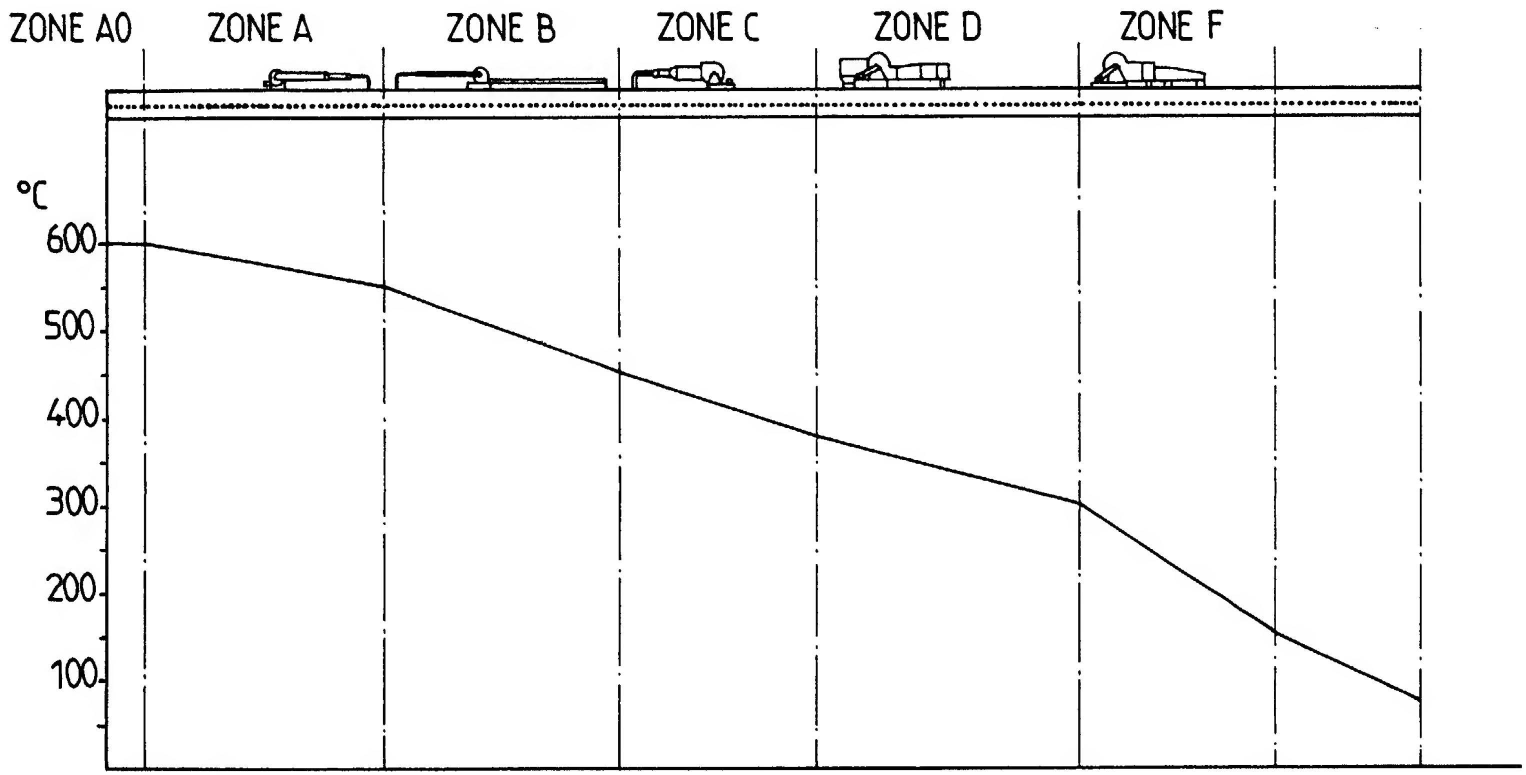
ZONE A0
ZONE A
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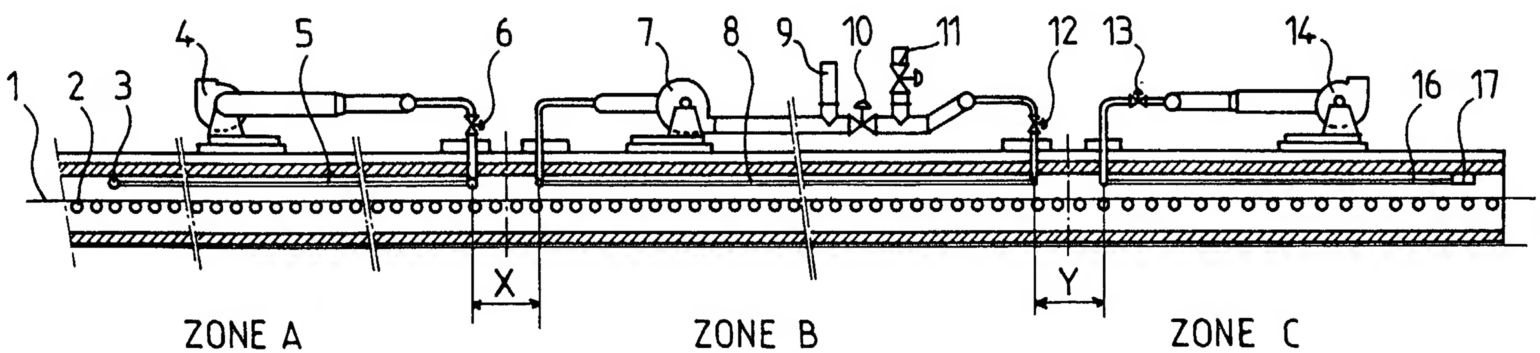
FIG.1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ZONE A
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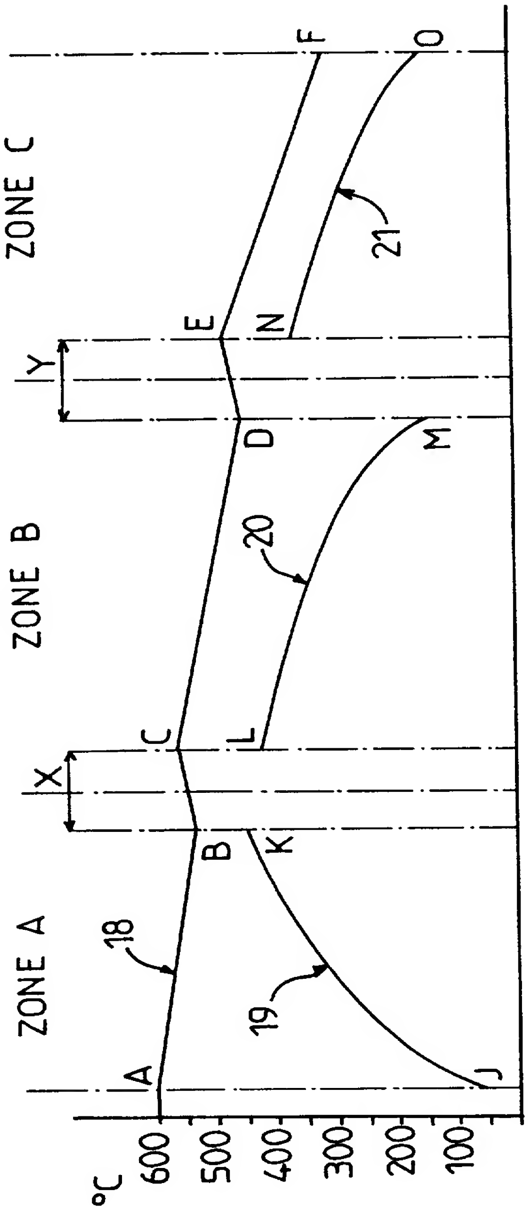
ZONE C

FIG.2


ZONE A
ZONE B
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A
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J
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Y
18
19
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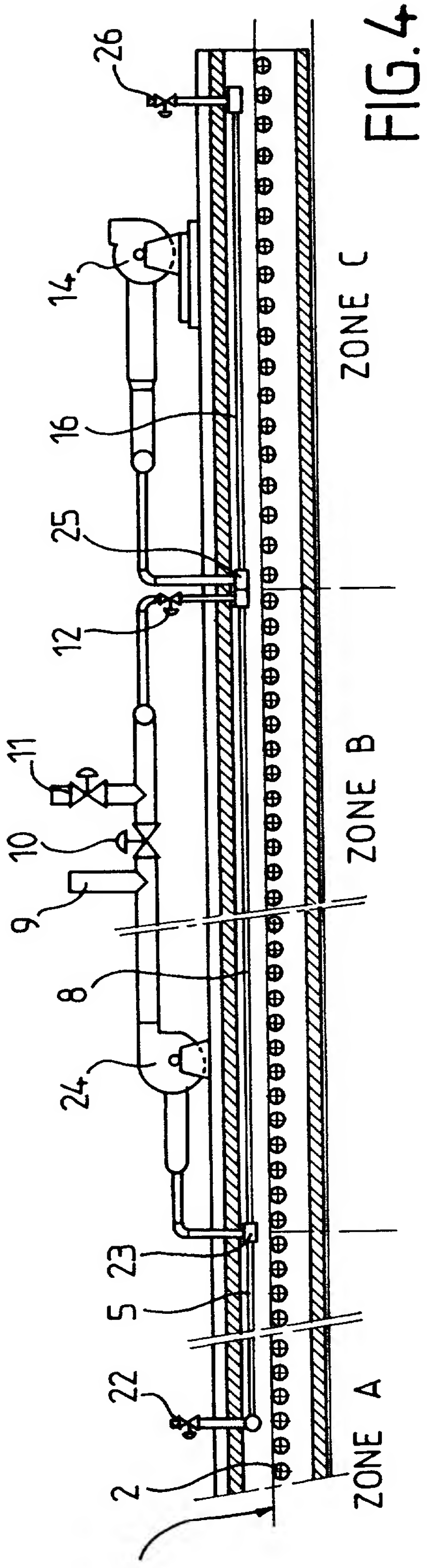
21

FIG. 3



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24
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9
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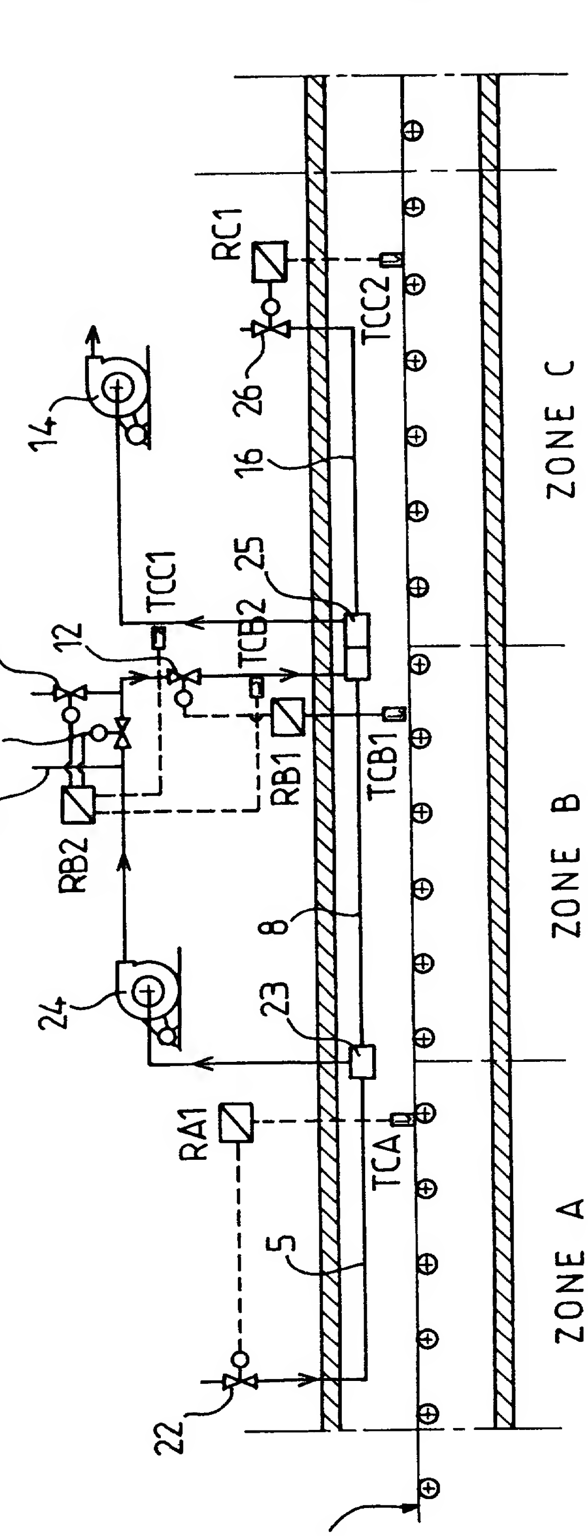
11
12
25
16
14
26
ZONE A
ZONE B
ZONE C

FIG.4



1
22
5
TCA
RA1
23
24
8
RB2
9
10
11
12
RB1
TCB1
TCB2
TCC1
25
16
26
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RC1
ZONE A
ZONE B
ZONE C

FIG.5

DECLARATION FOR PATENT APPLICATION

As a below-named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Improvements made to flat glass annealing lehrs.

the specification of which: (check one)

[ ] is attached hereto

[X] was filed on August 3, 2000 as ~~United States Patent Application Serial No. or~~ PCT International Application Number PCT/FR00/02242, and was amended on ____________ (if applicable)

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the patentability of this application in accordance with 37 CFR § 1 56(a)

Prior Foreign Application(s). I hereby claim foreign priority benefits under 35 U S.C. § 119(a)-(d) or §365(b) of any foreign application(s) for patent or inventor's certificate listed below, or § 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

(Application No.)	(Country)	(Day/Month/Year Filed)	Priority Claimed
99 10644	FRANCE	19 August 1999	[X] Yes [ ] No
			[ ] Yes [ ] No
			[ ] Yes [ ] No

I hereby claim the benefit under Title 35, United States Code § 119(e) of any United States provisional application(s) listed below·

Application No	Filing Date

I hereby claim the benefit under 35 U S C § 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by 35 U.S.C. § 112, first paragraph, I acknowledge the duty to disclose material information as defined in 37 CFR § 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

(U.S Application Serial No.)	(U.S. Filing Date)	(Status--patented, pending, abandoned)

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I hereby appoint the following registered practitioners Rudolf E. Hutz, Reg. No. 22,397; John D. Fairchild, Reg No. 19,756; Harold Pezzner, Reg No. 22,112; Richard M. Beck, Reg. No. 22,580; Paul E. Crawford, Reg. No. 24,397; Burton A. Amernick, Reg. No. 24,852; Morris Liss, Reg. No 24,510; George R. Pettit, Reg. No. 27,369; Patricia Smink Rogowski, Reg No. 33,791; Robert G. McMorrow, Jr , Reg. No 30,962, Ashley I. Pezzner, Reg. No. 35,646, William E. McShane, Reg. No 32,707; Mary W Bourke, Reg. No. 30,982, Gerard M. O'Rourke, Reg. No. 39,794; James M Olsen, Reg. No. 40,408; Francis DiGiovanni, Reg. No. 37,310; Eric J. Evain, Reg. No. 42,517; William E. Curry, Reg. No 43,572, David W Ward, Reg. No. 45,198; Daniel C Mulveny, Reg. No. 45,897; John A. Evans, (Agent) 44,100; and Elliot C. Mendelson (Agent), Reg. No. 42,878, with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.

Send Correspondence and Direct Telephone Calls to:
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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. § 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

1-00

Full name of sole or first inventor: Eric ALBRAND

Inventor's Signature ____________ Date January 14, 2002

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[ ] See next page for additional inventors

DECLARATION FOR PATENT APPLICATION

Page Two

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3-00

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Inventor's Signature Date January 14, 2002

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Citizenship FRANCE

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Full name of fourth joint inventor (if any):

Inventor's Signature Date

Residence Address

Citizenship

Post Office Address

Full name of fifth joint inventor (if any):

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Citizenship

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Citizenship

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